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1

ABSTRACT

Objectives: The factors determining individuals' behavioural responses to direct to consumer advertising of prescription medicines were explored with an emphasis on 'at risk' individuals' responses.

Design: Nationally representative cross-sectional survey.

Setting: Community living adults in New Zealand.

Participants: 2057 adults (51% female).

Primary outcome measures: Behavioural responses to medicine advertising (asking a doctor for a prescription, asking a doctor for more information about an illness, asking a pharmacist for more information about the advertised medicine and searching the Internet for more information regarding an illness)

Methods: Multivariate logistic regressions were employed to determine whether participants' behavioural responses to medicine advertising were predicted by attitudes towards advertising and pharmaceutical advertising, judgements about safety and effectiveness of advertised medicines, health status, materialism, online search behaviour, as well as demographics.

Results: Poorer health, favourable attitude towards medicine advertising, and using the Internet to search for medical information were predictors of all behavioural outcomes. A lower level of education was a predictor of asking a doctor for a prescription. Older age was associated with seeking more information from a doctor or pharmacist. A lower level of income was a predictor of all behavioural responses except for searching the internet. Respondents' ethnicity also influenced the behavioural responses to medicine advertising. A higher level of materialism was a predictor of all behavioural outcomes except for asking a

pharmacist for more information, and thus these ads may be appealing to individuals'

consumerism rather than purely providing information regarding medicines.

Conclusions: Taken together, these findings suggest individuals, especially who are 'at risk'

(i.e. with poorer health status, lower education, and lower income) may make uninformed

decisions. The outcomes raise significant concerns relating to the ethicality of medicine

advertising and suggest a need for stricter guidelines to ensure that medicine advertisements

provided by pharmaceutical companies are ethical.

Keywords: Direct to consumer advertising; Prescription medicines; Behavioural responses to

medicine advertising; Structural influence model of health communication; 'At risk'

individuals

ARTICLE SUMMARY

Strengths and limitations of this study

- A strength of this study is the use of large and representative sample, so that the findings

  can be generalized to national population in New Zealand.

- This is the first study to explore the factors determining individuals' behavioural

  responses to direct to consumer advertising of prescription medicines in New Zealand and

  at a population level.

- This is the first study to explore the relationship between materialism and responding to

  medicines advertising.

- The cross-sectional study does not explore the causal relationships between dependent

  and independent variables.

INTRODUCTION

Direct to consumer advertising (DTCA) of prescription medicines is a controversial pharmaceutical marketing strategy.[1] Currently, it is only legal in New Zealand and the USA, [2-6] although the European Commission has considered a proposal for advertising medicines,[7] and advertising on the internet can cross geographical boundaries. Of concern, the vast and disparate information in medicine advertising reaches consumers directly, bypasses central gatekeepers (physicians, pharmacists, and other healthcare professionals), and poses challenges to individuals to make informed choices.[8] Supporters of medicine advertising claim that it improves individuals' autonomy by increasing awareness of medical problems, symptoms, and existing treatments; accordingly, it can assist patients to make superior medical decisions.[4 9-12] However, opponents argue that the primary motive of the pharmaceutical industry is profit rather than to help individuals make informed health-related decisions.[13-16] The industry spends billions of dollars annually on promotion [17] to push consumers to buy the advertised medicine, spending more on promotion than research and development.[18] Such advertising has been blamed for changing the pattern of use of healthcare services,[19] including medicalising normal human conditions,[19] driving overconsumption of new prescription medicines and motivating requests for more expensive, medications.[5 20] For instance, in countries with a socialised health system, such as New Zealand, where the government subsidises generic medicines, advertising can convince patients to request a non-subsidised branded medication over a subsidised generic one. The prescription charge for each subsidised medication is $5 and there may be an additional (sometimes substantial) cost if the medicine is not fully subsidised.[21] Further, exposure to health information through DTCA does not necessarily lead to knowledge[11] and can result in consumers requesting a medicine that they do not actually need.[22] Thus, the question arises as

4

to whether individuals are able to make informed decisions in response to medicine

advertising.

There is a lack of research examining possible communication disparities in response

to medicine advertising,[23] and researchers have suggested the need for detailed examinations

of responses of various social groups.[8] Models of medicine advertising commonly assume

identical attention, processing, and behaviour among individuals. However, if information is

not suitably fitted to individuals' needs and knowledge, it can limit their ability to make

informed decisions instead of strengthening it.[24] The structural influence model (SIM) of

health communication suggests that social determinants are linked to health communication

outcomes and theorises that health communication disparities can be seen in terms of

inequalities in how people act on heath information.[25] Assuming that there may be

differences between social groups in their ability to process and respond to medicine

advertising, it is important to understand the outcomes of exposure to DTCA between

different social groups.[8] Earlier research on health communication shows that older, less

educated, and lower-income individuals are potentially more susceptible than others to the

medication information gap.[26] For instance, older people who ask for medications after

exposure to medicine advertisements can unintentionally complicate the patient-physician

relationship, particularly if an advertisement has misinformed them about the effectiveness of

the medicine.[27] People with poorer health may similarly be more susceptible to medicine

advertising. Given the growing concern about the role of health literacy and social imbalance

in health-related outcomes, more studies have to be conducted to map the paths between

social determinants and health-related consequences.[28 29] Drawing on the structural influence

model of health communication, the present study explored whether there was any social

imbalance as a function of individual characteristics with regards to responding to medicine

advertising. Using a representative sample within New Zealand, we aimed to find out

5

whether 'at risk' individuals (older, less educated, with lower income, lower occupational status, and poorer health) were more likely to be influenced by this advertising.

Research has also focused on the role of other personal characteristics in determining responses to advertising. Positive attitudes towards medicine advertising predict behavioural intentions and responses to such advertising.[30-32] Materialism is associated with purchasing behaviour in general and lower psychological well-being,[33] but no previous research has explored the influence of being materialistic on the response to medicine advertising. People are increasingly searching for medical information on the Internet [34] but this may differ by education, income, and ethnicity. These inequalities in Internet usage may intensify health inequalities among different groups.[35-37] Therefore, this study also examined the influence of attitude, being materialistic, and use of the Internet to search for medical information on behavioural responses to medicine advertising.

METHODS

Source of Data

This study analysed a subset of pharmaceutical and health-related questions from a large online survey covering a range of attitudes, behaviour, consumption, and lifestyle questions. Data collection was performed in late 2013 by an Australasian market research company. Quota sampling was used for selecting the survey participants. The instructions were that the respondents were to be over 18 and demographically representative of the New Zealand population in terms of age, sex, education, ethnicity, and income. 2057 usable responses were retained for analysis. Since an independent panel survey was used, it was not possible to calculate a response rate (participants were signed up to complete the surveys that were sent). This study had ethics approval from the University of Otago, and all participants gave their written consent.

Variables

Dependent variables

Behavioural responses after exposure to a medicine advertisement were measured through four yes/no statements: asking a physician for a prescription,[38] asking a physician for more information about an illness,[38] searching the Internet for more information regarding an illness,[39] and asking a pharmacist for more information about the advertised medicine.[38]

Independent variables (predictors)

Measures of attitudes and knowledge were made on a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). Participants were asked about their overall attitude toward advertising,[40] general attitude toward DTCA,[32 41] knowledge about the safety of advertised medicines,[42 43] and knowledge about the effectiveness of medicines.[43] Health status was measured by asking respondents' satisfaction with their health on a 10-point Likert scale from 1 (completely dissatisfied) to 10 (completely satisfied).[42] Materialism was measured by eighteen statements on a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree),[44] and subsequently, respondents were divided by a median split into 'low materialism' or 'high materialism'. Based on omega and alpha estimates, the internal consistency (reliability) of the scale was good ($\omega = 0.81$ [95% C.I. 0.80, 0.82], $\alpha=0.81$ [0.80, 0.82]). Use of the Internet to search for medical information was measured by the sum of two yes/no items; i.e., searching for medical advice online, and visiting a health related blog ($\omega = 0.72$ [0.70, 0.74], $\alpha=0.70$ [0.67, 0.72]). Demographic information on age (as a continuous variable), gender, ethnicity (as multiple dummy variables), education, income, and occupation (as multiple dummy variables) were also used.

7

Data Analysis

Data was analysed with IBM SPSS Statistics for Windows, Version 22.0, Armonk, NY: IBM Corp. Descriptive statistics were used to calculate frequencies, mean, and standard deviation of items. Omega and alpha estimates of reliability were calculated using the 'MBESS' package in R. Multivariate binary logistic regression models were used to show how strongly independent variables were associated with behavioural responses to DTCA, and subsequently to reveal the factors determining behavioural outcomes. The association between each independent and dependent variable was examined using odds ratios (ORs). The statistical significance of each coefficient in the model was defined by the 95% confidence interval (CI). Predictive accuracy and overall appropriateness of the models were examined by non-significant ($p > 0.05$) Hosmer–Lemeshow tests (Hosmer et al., 2013)[45] and significant ($p < 0.01$) Omnibus test of model coefficients.

RESULTS

Sample characteristics

The demographics of the sample are presented in Table 1. Table 2 shows the means and standard deviations for non-demographic independent variables. 60% of respondents considered themselves in good health. 5.2% were completely satisfied with their overall health, 25% were dissatisfied, and only 3.4% were completely dissatisfied with their overall health. 48% had looked for medical information online. Almost a third of the sample (30.7%) believed that DTCA was helpful for consumers, 43.7% thought that only medicines that are completely safe could be advertised, and 35.3% believed that only medicines that are extremely effective could be advertised. Moreover, as a result of seeing DTCA, 11.4% of participants asked their physicians for a prescription, 15.9% asked their physicians for more

8

information, 34.4% searched the internet for more information and 16.2% asked their

pharmacists for more information.

Table 1

Demographics of the Sample (n=2057)

Variable	Frequency (%)	Mean	S.D.
Age (yr)		44.21	17.6
Education		…	
No secondary schooling	61 (3.0)		
School examinations only	165 (8.0)		
School certificate examination only	355 (17.3)		
University entrance/ Matriculation only	277 (13.5)		
Technical or trade certificates	329 (16.0)		
Professional training	215 (10.5)		
University qualifications	655 (31.8)		
Ethnicity		…	
NZ European	1290 (62.7)		
Maori	218 (10.6)		
Chinese	74 (3.6)		
Indian	79 (3.8)		
Pacific Islands	68 (3.3)		
'Other' Ethnicities	328 (15.9)		
Gender		…	

Male	1001 (48.7)
Female	1056 (51.3)

Income	…
Less than $20,000	199 (9.7)
$20,000 to $39,999	460 (22.4)
$40,000 to $59,999	413 (20.1)
$60,000 to $79,999	338 (16.4)
$80,000 to $99,999	212 (10.3)
$100,000 to $119,999	202 (9.8)
Over $120,000	232 (11.3)

Occupation	…
Working for someone else full time	684 (33.3)
Working for someone else part time	275 (13.4)
Self-employed	166 (8.1)
Temporarily unemployed	144 (7.0)
Retired	337 (16.4)
Student	273 (13.3)
Full-time homemaker	178 (8.7)

Table 2

Non-demographic independent variables

Items	Mean (SD)
Only drugs that are completely safe can be advertised in NZ	3.28 (1.18)

10

Only drugs that are extremely effective can be advertised in NZ	3.11 (1.12)
Overall, I believe that advertising of medicine is good for consumers	3.00 (1.02)
Overall, I consider advertising a good thing	3.07 (0.92)
Health Status	5.98 (2.47)
Materialism	…
Searching online health Information	0.71 (0.82)

Predictors of behavioural outcomes

Results of the logistic regression analyses predicting each behavioural outcome are

shown in Table 3. Having asked a physician for a prescription after seeing a medicine

advertisement was associated with higher materialism, more positive attitude towards DTCA,

and using the Internet to search for health information, in addition to poorer health status,

lower education, and lower income. Indian and Chinese respondents were more likely to ask

physicians for a prescription, relative to New Zealand Europeans. This model explained

14.8% (Nagelkerke R^2) of the variation in asking a doctor for a prescription. The non-

significant result of Hosmer–Lemeshow test ($\chi^2 = 10.56$, d.f. = 8, $p = 0.23$), and the

significant result of Omnibus Tests of Model Coefficients ($p < 0.001$), revealed that the

model had a good fit to the data.

Having asked a physician about an illness after seeing a medicine advertisement was

associated with older age, higher materialism, more positive attitude towards DTCA, and

using the Internet to search for health information, as well as poorer health status and lower

income. Maori, Chinese, and Indian respondents were more likely to ask their physicians for

information about an advertised medicine than New Zealand Europeans. This model

11

explained 14.9% (Nagelkerke R^2) of the variation in asking a doctor about an illness. The

non-significant result of Hosmer–Lemeshow test ($\chi^2 = 12.44$, d.f. = 8, $p = 0.13$), and the

significant result of Omnibus Tests of Model Coefficients ($p < 0.001$) again showed a good

model fit.

Having searched the Internet for more information regarding an illness after seeing a

medicine advertisement was associated with higher materialism, more positive attitude

towards DTCA, and using the Internet, along with poorer health status. Females were more

likely than males to search the Internet for more information regarding an illness after

exposure to DTCA. This model explained 20.7% (Nagelkerke R^2) of the variation in

searching the Internet for more information regarding an illness. The non-significant result of

Hosmer–Lemeshow test ($\chi^2 = 12.31$, d.f. = 8, $p = 0.14$), and the significant result of Omnibus

Tests of Model Coefficients ($p < 0.001$) showed a good fit.

Having asked a pharmacist for more information about an advertised medicine after

seeing a medicine advertisement was associated with older age, more positive attitude

towards DTCA, and using the Internet, as well as poorer health status and lower income.

Maori, Chinese, and 'other' ethnicities were more likely than New Zealand European

respondents to ask pharmacists for more information. This model explained 10.3%

(Nagelkerke R^2) of the variation in asking a pharmacist for more information about an

advertised medicine. Model fit was again good with a non-significant result of Hosmer–

Lemeshow test ($\chi^2 = 5.50$, d.f. = 8, $p = 0.70$), and significant result of Omnibus Tests of

Model Coefficients ($p < 0.001$).

Table 3

Summary of multivariate binary logistic regression models predicting DTCA-triggered

behaviours

Variable	Asking a doctor for a prescription: OR (95% CI)	Asking a doctor for more information about an illness: OR (95% CI)	Searching the Internet for more information regarding an illness: OR (95% CI)	Asking a pharmacist for more information about the advertised medicine: OR (95% CI)
Age	1.00 (0.99-1.01)	1.02 (1.01-1.04)***	1.01 (0.999-1.02)	1.02 (1.005-1.03)**
Annual Income	0.89 (0.81-0.98)*	0.89 (0.82-0.96)**	0.99 (0.93-1.05)	0.91 (0.84-0.98)*
Ethnicity				
New Zealand European	1.00	1.00	1.00	1.00
Maori	1.30 (0.82-2.04)	1.77 (1.20-2.61)**	1.06 (0.76-1.48)	2.06 (1.42-3.01)***
Chinese	2.14 (1.09-4.22)*	1.92 (1.001-3.68)*	1.21 (0.71-2.06)	2.51 (1.38-4.56)**
Indian	4.90 (2.75-8.73)***	3.85 (2.19-6.76)***	1.56 (0.92-2.63)	1.76 (0.96-3.23)
Pacific Island	0.86 (0.38-1.94)	1.31 (0.65-2.63)	1.08 (0.62-1.87)	1.66 (0.86-3.17)

'Other' Ethnicities	1.21 (0.78-1.88)	1.36 (0.94-1.96)	1.27 (0.96-1.69)	1.78 (1.27-2.50)**
Gender	0.75 (0.54-1.04)	0.82 (0.62-1.09)	1.36 (1.08-1.7)**	1.09 (0.83-1.43)
Health Status	0.93 (0.88-0.99)*	0.93 (0.89-0.98)**	0.89 (0.86-0.93)***	0.94 (0.90-0.99)*
Occupation				
Unemployed	1.00	1.00	1.00	1.00
Working Fulltime	0.91 (0.52-1.58)	0.95 (0.58-1.56)	1.47 (0.95-2.28)	1.18 (0.71-1.97)
Working Part-Time	0.68 (0.37-1.25)	0.79 (0.46-1.35)	1.14 (0.71-1.83)	0.74 (0.42-1.30)
Self-Employed	1.05 (0.53-2.07)	0.52 (0.27-1.01)	1.08 (0.63-1.84)	0.997 (0.54-1.86)
Retired	0.67 (0.34-1.34)	0.57 (0.32-1.03)	1.10 (0.66-1.84)	0.77 (0.43-1.40)
Student	0.51 (0.26-1.01)	1.14 (0.63-2.07)	1.56 (0.94-2.58)	0.78 (0.42-1.46)
Fulltime Homemaker	0.81 (0.41-1.59)	0.58 (0.31-1.11)	0.93 (0.55-1.56)	0.96 (0.52-1.75)
Level of Education	0.89 (0.82-0.96)**	0.96 (0.89-1.03)	0.99 (0.93-1.05)	1.03 (0.96-1.10)
Attitude toward Advertising	1.01 (0.85-1.20)	1.08 (0.93-1.26)	1.1 (0.97-1.23)	1.15 (0.99-1.33)
Attitude toward DTCA	1.62 (1.35-1.93)***	1.53 (1.31-1.78)***	1.34 (1.19-1.51)***	1.39 (1.20-1.61)***
Materialism	2.02 (1.46-	1.50 (1.15-	1.43 (1.15-	1.17 (0.90-1.53)

14

	2.79)***	1.98)**	1.78)**	
Searching Online Health Info	1.34 (1.13-1.59)**	1.68 (1.45-1.95)***	2.36 (2.09-2.67)***	1.32 (1.14-1.53)***
View on Effectiveness of Advertised Medicines	1.19 (0.95-1.48)	1.06 (0.88-1.28)	1.02 (0.88-1.18)	1.04 (0.87-1.24)
View on Safety of Advertised Medicines	0.87 (0.71-1.07)	0.90 (0.75-1.07)	0.94 (0.82-1.08)	1.02 (0.86-1.21)

Note: *$p < 0.05$ **$p < 0.01$ ***$p < 0.001$

DISCUSSION

The current findings revealed that individuals lack knowledge regarding the regulation and safety of medicine advertising with nearly half of all participants believing that only drugs that are completely safe could be advertised. Similarly, a substantial number of individuals thought that only drugs that are extremely effective could be advertised. These findings are of particular concern given that advertising may induce unwarranted inferences and change individuals' beliefs over time[46] and some drugs that are advertised directly to consumers have serious side effects. For instance, Vioxx® (rofecoxib) was heavily advertised for five years in more than 80 countries, including New Zealand. However, it was subsequently withdrawn from the worldwide market in 2004 over safety concerns about increased risk of heart attack and stroke.[47-49] Moreover, the findings of this study revealed that participants responded to medicine advertising by seeking the medication or further information after being exposed to medicine advertisements. This can lead to individuals

15

asking for an unsuitable or unnecessary medication that may subsequently lead to an

inappropriate or excessive prescription.

Of concern, we also found disparities in behavioural responses to medicine

advertising with individuals most at risk of harm being more likely to respond to such

advertising. In particular, respondents with poorer health status were more likely to show all

behavioural responses. Older individuals were also more likely to seek more information

from a doctor or pharmacist. Furthermore, respondents with a lower level of education were

more likely to ask a doctor for a prescription. Those with lower income were more likely to

show all behavioural responses except for searching the internet. Respondents' ethnicity also

influenced the behavioural responses to DTCA. These findings are consistent with the

structural influence model of health communication, which suggests that differences in health

behaviours among different social groups can be explained by focusing on how social

determinants are linked to health communication outcomes.[8 50] Materialism was also a

positive predictor of asking a doctor for a prescription, asking a doctor for more information,

and searching the internet for more information. Favourable attitude towards medicine

advertising, as well as a history of searching the Internet for medical information predicted all

behavioural outcomes. We consequently discuss communication inequalities and the

associated ethical issues surrounding medicine advertising.

The current findings showed that individuals who were more 'at risk' might also be

more vulnerable to medicine advertising. Moreover, the fact that individuals responded to

medicine advertising based on their favourable attitudes suggests these individuals might be

more likely to make uninformed decisions, particularly since medicine advertisements often

present patient success stories, which can mislead the public.[51] This is of significant concern

given that many of the participants had inaccurate knowledge regarding the safety and

effectiveness of advertised medicines when in fact, medicine advertising is self-regulated in

New Zealand.[4 52] Furthermore, the finding that more materialistic individuals were more likely to be influenced by DTCA suggests that medicine advertising is appealing to individuals' desire to consume more so than acting as a form of health information. Reliance on the Internet for medical information also predicted behavioural responses to DTCA. Pharmaceutical companies could thus improve the ethicality of their advertising by utilizing this channel to develop patient support and offer informative online DTCA, which can help people to have more effective discussions with health professionals.

These findings, however, are based on cross-sectional data. Future longitudinal studies could further explore the effects of social determinants, personal characteristics, and exposure to medicine advertisements on health communication outcomes, including medicine purchasing.

The outcomes from our large representative sample can be generalized to national population in New Zealand and have important implications for both health care policy makers and pharmaceutical companies. We suggest that regulations on medicine advertising should be tightened. Moreover, health policymakers should increase knowledge regarding medicine advertising and let individuals know that advertised medications are not necessarily safe and effective. Health policymakers can also concentrate on people's attitudes towards DTCA of prescription medicines, and let them know that it is a paid promotion conveyed by pharmaceutical companies. Health professionals could be well informed of all medications prior to them being advertised to help individuals make safe choices. Furthermore, pharmaceutical companies should advertise their medicines responsibly and educate individuals about treatments constructively since people, especially those who are more vulnerable, may ask for a medication that they do not need. Medicine advertisements can discuss lifestyle alternatives to taking medicines and state that there are other medications available, which may have the identical effects.

17

CONCLUSIONS

While much attention has been paid to behavioural responses to medicine advertising, to the best of our knowledge, no study has documented 'at risk' individuals' responses to medicine advertising. This study, therefore, grounded in communication inequality and the structural influence model, presented the factors prompting actual behavioural responses to DTCA. This research found that 'at risk' individuals were more susceptible to DTCA as supported by the representative empirical findings. Furthermore, the outcomes revealed the importance of attitudes towards DTCA over and above knowledge of regulation and safety of advertised medicines, which can leave individuals vulnerable to medicine advertising and at risk of making uninformed decisions accordingly. To the extent of our knowledge, this study is also the first to consider whether behavioural responses to medicine advertising are also associated with materialism. Respondents who were more materialistic were more likely to be affected by DTCA, indicating DTCA is appealing to individuals who value consuming, a trait that is associated with lower psychological well-being.[33]

Taken together, the outcomes suggest DTCA affects the most 'at risk' individuals, who are motivated to consume, and who base their decisions on their attitudes. The findings raise significant concerns regarding ethicality of DTCA and suggest a need for policy developments to ensure medicine advertisements are ethical and do not cause misuse or overuse of medications.

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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	1
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-5
Objectives	3	State specific objectives, including any prespecified hypotheses	4-5
Methods			
Study design	4	Present key elements of study design early in the paper	5-6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6-7
Bias	9	Describe any efforts to address potential sources of bias	5
Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6-7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7
		(*b*) Describe any methods used to examine subgroups and interactions	7
		(*c*) Explain how missing data were addressed	No missing data
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	NA
		(*e*) Describe any sensitivity analyses	NA
Results			

43
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Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	5
		(b) Give reasons for non-participation at each stage	NA
		(c) Consider use of a flow diagram	NA
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	7-9
		(b) Indicate number of participants with missing data for each variable of interest	NA
Outcome data	15*	Report numbers of outcome events or summary measures	7-8
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	10-14
		(*b*) Report category boundaries when continuous variables were categorized	NA
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	NA
Discussion			
Key results	18	Summarise key results with reference to study objectives	14-16
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	16
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	14-17
Generalisability	21	Discuss the generalisability (external validity) of the study results	16
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	18

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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'At risk' individuals' responses to direct to consumer advertising of prescription drugs: A nationally representative cross-sectional study

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1
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'At risk' individuals' responses to

direct to consumer advertising of prescription drugs:

A nationally representative cross-sectional study

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ABSTRACT

Objectives: The factors determining individuals' self-reported behavioural responses to direct to consumer advertising of prescription drugs were explored with an emphasis on 'at risk' individuals' responses.

Design: Nationally representative cross-sectional survey.

Setting: Community living adults in New Zealand.

Participants: 2057 adults (51% female).

Primary outcome measures: Self-reported behavioural responses to drug advertising (asking a doctor for a prescription, asking a doctor for more information about an illness, searching the Internet for more information regarding an illness, and asking a pharmacist for more information about a drug).

Methods: Multivariate logistic regressions determined whether participants' self-reported behavioural responses to drug advertising were predicted by attitudes towards advertising and drug advertising, judgements about safety and effectiveness of advertised drugs, self-reported health status, materialism, online search behaviour, as well as demographics.

Results: Poorer self-reported health status (ORs: 0.90-0.94, all ps < 0.05), favourable attitude towards drug advertising (ORs: 1.34-1.61, all ps < 0.001), and using the Internet to search for medical information (ORs: 1.32-2.35, all ps < 0.01) predicted all self-reported behavioural outcomes. Older age (ORs: 1.01-1.02, ps < 0.01), less education (OR: 0.89, p < 0.01), lower income (ORs: 0.89-0.91, ps < 0.05), higher materialism (ORs: 1.02-1.03, ps < 0.01) and ethnic minority identification also predicted one or more self-reported behavioural responses.

Conclusions: Taken together, the findings suggest individuals, especially those who are 'at risk' (i.e. with poorer self-reported health status, older, less educated, lower income, and ethnic minorities) may be more vulnerable to drug advertising and may make uninformed

2

decisions accordingly. The outcomes raise significant concerns relating to the ethicality of

drug advertising and suggest a need for stricter guidelines to ensure that drug advertisements

provided by pharmaceutical companies are ethical.

ARTICLE SUMMARY

Strengths and limitations of this study

- A strength of this study is the use of the large and representative sample so that the

  findings can be generalized to the national population of New Zealand.

- This is the first study to explore the factors determining individuals' self-reported

  behavioural responses to direct to consumer advertising of prescription drugs in New

  Zealand and at a population level.

- This is the first study to explore the relationship between materialism and self-reported

  behavioural responses to drug advertising.

- The cross-sectional study does not explore the causal relationships between dependent

  and independent variables.

- The findings of this study were based on self-reported behavioural responses to drug

  advertising and might not reflect individuals' actual behavioural responses.

INTRODUCTION

Direct to consumer advertising (DTCA) of prescription drugs is a controversial pharmaceutical marketing strategy.[1] Currently, it is only legal in New Zealand and the USA, [2-6] although advertising on the internet can cross geographical boundaries and the European Commission has considered a proposal for drug advertising.[7] A health communication tool such as DTCA can have positive or negative consequences.[8] The outcomes of DTCA depend on the types of advertised drugs and the nature of the illnesses to be treated. "DTCA is most likely to deliver public health benefits when the condition to be treated is serious and when the treatment is safe, effective, and underused. However, DTCA will tend to deliver net harms when the condition is mild or trivial and when the treatment is potentially dangerous, marginally effective, or overused" (p. 0286).[8] Furthermore, the effect of DTCA varies depending on how individuals interpret and respond to the information. Of concern, the vast and disparate information in drug advertising reaches individuals directly and poses challenges to individuals to make informed choices on whether the advertised drugs will be beneficial or deleterious.[9] Supporters of drug advertising claim that it improves individuals' autonomy by increasing awareness of medical problems, symptoms, and existing treatments; accordingly, it can assist patients to make superior medical decisions.[4 10-13] However, exposure to health information through DTCA does not necessarily lead to knowledge[12] and can result in individuals requesting a drug that they do not actually need.[14] Studies show that individuals typically understand the benefits far better than the risks.[15] Furthermore, new drugs presented in DTCA may have unknown side effects or safety issues.[16] Opponents of DTCA argue that the primary motive of the pharmaceutical industry is to increase profit rather than to help individuals make informed health-related decisions.[17-20]

The pharmaceutical industry spends billions of dollars annually on promotion[21] to push consumers to buy the advertised medications, spending more on promotion than

4

research and development.[22] Such advertising has been blamed for changing the pattern of

use of healthcare services,[23] including medicalising normal human conditions,[23] driving

overconsumption of new prescription drugs and motivating requests for more expensive

medications.[5 24] For instance, in countries with a socialised health system, such as New

Zealand, where the government subsidises generic drugs, advertising can convince patients to

request a non-subsidised branded medication over a subsidised generic one. The prescription

charge for each subsidised medication is $5, whereas there may be an additional (sometimes

substantial) cost if the drug is not fully subsidised.[25] Prescription drugs must be prescribed by

physicians, and medical professionals act as gatekeepers between DTCA and individuals.

However, as a result of drug advertising, patients may pressure physicians to prescribe the

advertised branded drugs, and patients' requests for specific drugs significantly increase the

likelihood that requested drugs are prescribed.[8 26 27] Physicians also report that DTCA

negatively influences the physician-patient relationship because patients challenge their

knowledge based on information they have received through drug advertising.[28 29] The

interference in the physician-patient relationship can result in ill-informed patients and

treatments that are not fully tailored to the patients' conditions.[30] Consequently, the question

arises as to whether individuals are able to make informed decisions in response to drug

advertising.

There is a lack of research examining possible communication disparities in response

to drug advertising,[31] and researchers have suggested the need for detailed examinations of

responses of various social groups.[9] Models of drug advertising commonly assume identical

attention, processing, and behaviour among individuals. However, if the information is not

suitably fitted to individuals' needs and knowledge, it can limit their ability to make informed

decisions instead of strengthening it.[32] The structural influence model (SIM) of health

communication suggests that social determinants are linked to health communication

5

outcomes and theorises that health communication disparities can be seen in terms of inequalities in how people act on heath information.[33] Similarly, there might be disparities in individuals' responses to drug advertising. Assuming that there might be differences between social groups in their ability to process and respond to drug advertising, it is important to understand the outcomes of exposure to DTCA between different social groups.[9] The current study, therefore, explored whether there were communication disparities in self-reported behavioural responses to DTCA, focussing in particular on 'at-risk' individuals' responses.

In healthcare, the terms 'vulnerable' or potentially 'at-risk' are used to refer to individuals who are ethnic minorities, children, elderly, those with certain medical conditions, as well as socioeconomically disadvantaged individuals, such as those with a lower level of education and/or a lower level of income.[34-36] 'At risk' individuals are more likely to experience a medical information gap. For instance, older individuals are more vulnerable to DTCA than are younger individuals because they tend to obtain less information from the advertisements[30] and are more likely to misinterpret information on the effectiveness of advertised drugs.[37] The misinterpretation of a drug's effectiveness can complicate the patient-physician relationship if the patient requests the advertised drug.[37] While younger adults might also misinterpret information in DTCA, older adults are more likely to have several medical conditions requiring more prescription drugs and are therefore more likely to be effected by communication gaps in drug advertisements.[30] Less educated and lower income individuals may obtain less information from drug advertisement and may be more vulnerable than others to the medication information gap.[30] People with poorer health may similarly be more vulnerable to drug advertising as they have also been defined as vulnerable populations in the medical domain[34 35] and they may need to use more prescription drugs. Furthermore, research typically shows health outcomes for ethnic minorities poorer compared to the majority populations.[35 36 38-40] For example, earlier research has reported

6

dissimilarities in health outcomes of different ethnicities in the United States and New

Zealand. In both countries, poorer health outcomes were found among the minority

populations. Ethnic minorities can, therefore, be considered as vulnerable or 'at risk'

people.[39] Given the growing concern about the role of health literacy and social imbalance in

health-related outcomes, more studies have to be conducted to map the paths between social

determinants and health-related consequences.[41][42] Drawing on the structural influence model

of health communication, the present study explored whether there was any social imbalance

as a function of individual characteristics with regards to responding to drug advertising.

Using a representative sample within New Zealand, this study examined whether 'at risk'

individuals (with poorer self-reported health status, older, less educated, lower income, lower

occupational status, and ethnic minorities) were more likely to be influenced by drug

advertising.

Research has also focused on the role of attitudes and personal characteristics in

determining responses to advertising. Positive attitudes towards drug advertising predict

behavioural intentions and responses to such advertising.[43-45] Thus, the present study

examined the influence of attitudes toward advertising and DTCA on perceived behavioural

responses to drug advertising. In addition, this study explored the personal trait of

materialism to examine whether there was a relationship between materialistic traits and

responding to DTCA. Materialism emphasizes the importance placed on goods and their

purchase to help achieve desired goals or situations.[46] A defining characteristic of highly

materialistic individuals is a belief that well-being can be enhanced through one's

relationships with objects (p. 349).[47] Materialistic individuals have strong bonds with brands

as a means of managing existential insecurity.[48] Materialism is linked with physical

symptoms, drug use,[49][50] and lower subjective well-being.[51-57] Moreover, higher materialistic

individuals show greater attention to advertising.[58] Materialism is also an important

7

determinant of addictive purchase and compulsive consumption.[52 59-62] Since individuals

higher in materialism are more likely to attend to advertising, to engage in compulsive

consumption, and to believe consumption improves well-being, materialistic individuals

might also be more likely to respond to DTCA, especially given that DTCA markets drugs to

individuals in the same fashion as other fast moving consumer goods. However, no previous

research has explored the relationships between materialism and responses to drug

advertising. Therefore, the current study examined the effects of materialism on self-reported

behavioural responses to DTCA. In addition, people are increasingly searching for medical

information on the Internet,[63] but this may differ by education, income, and ethnicity. These

inequalities in Internet usage may intensify health inequalities among different groups.[64-66]

Therefore, this study also examined the influence of the use of the Internet to search for

medical information on self-reported behavioural responses to drug advertising.

METHODS

Source of Data

This study analysed a subset of pharmaceutical and health-related questions from a

large online survey covering a range of attitudes, behaviour, consumption, and lifestyle

questions. Data collection was performed in late 2013 by Research Now, a leading market

research company operating in more than 40 countries with over 11 Million panelists. Quota

sampling was used for selecting the survey participants. The instructions were that the

respondents were to be demographically representative of the New Zealand population in

terms of age, sex, education, ethnicity, and income. The full survey instrument took

approximately 40 minutes to complete. 2057 usable responses were retained for analysis.

Since an independent panel survey was used, it was not possible to calculate a response rate

(participants were signed up to complete the surveys that they were sent). All participants

answered all of the questions used in this study since the questions were not based on a

response logic of any earlier item in the questionnaire. This study had ethics approval from

the University of Otago, and all participants gave their written consent.

Variables

Dependent variables

Perceived effects of DTCA on individuals were measured by asking participants to

report their behavioural responses after exposure to a drug advertisement through four yes/no

questions drawn from previous studies: 1) As a result of seeing an advertisement for a drug

have you asked your doctor for a prescription?[67] 2) As a result of seeing an advertisement for

a drug have you asked your doctor for more information about an illness?[67] 3) As a result of

seeing an advertisement for a drug have you searched the internet for more information

regarding an illness?[68] 4) As a result of seeing an advertisement for a drug, have you asked

your pharmacist for more information about a drug?[67]

Independent variables (predictors)

Measures of attitudes and knowledge were made on a 5-point Likert scale from 1

(strongly disagree) to 5 (strongly agree). Participants were asked about their general attitude

toward advertising,[69] attitude toward DTCA,[45 70] knowledge about the safety of advertised

drugs,[71 72] and knowledge about the effectiveness of drugs.[72] Self-reported/subjective health

status, a valid and widely used indicator of health conditions,[73-76] was measured by asking

respondents' self-rated satisfaction with their health on a 10-point Likert scale from 1

(completely dissatisfied) to 10 (completely satisfied).[71] Materialism was measured by using

Richins and Dawson's Materialism Value Scale, including eighteen statements on a 5-point

Likert scale from 1 (strongly disagree) to 5 (strongly agree).[46] Richins and Dawson's scale

9

has been widely used in consumer research,[47 77-80] and shown robust psychometric properties

in international research.[47 81] This scale was originally argued to have three subscales

(centrality, happiness, success), but this dimensional structure is not consistently found in the

data.[82 83] In this study, the EFA/CFA found evidence for a 2-factor model, but with all the

negatively worded items loading on the second factor, suggesting that this factor is an

artefactual factor, based on the positive or negative wording of items, rather than a real latent

dimension.[84 85] Moreover, previous research has revealed that although there are three

dimensions in the original scale, items can be summed to reflect an overall materialism

score.[86] Accordingly, in line with common practice, a total materialism score was

computed.[86-90] Based on omega and alpha estimates, the internal consistency (reliability) of

the scale was good (ω = 0.81 [95% C.I. 0.80, 0.82], α=0.81 [0.80, 0.82]). Use of the Internet

to search for medical information was measured by the sum of two yes/no items; i.e.,

searching for medical advice online, and visiting a health related blog (ω = 0.72 [0.70, 0.74],

α=0.70 [0.67, 0.72]). Demographic information on age (as a continuous variable), gender,

ethnicity (as multiple dummy variables, with New Zealand European as the reference level),

education, income, and occupation (as multiple dummy variables, with unemployed as the

reference level) were also used.

Data Analysis

Data were analysed with IBM SPSS Statistics for Windows, Version 22.0, Armonk,

NY: IBM Corp. Descriptive statistics were used to calculate frequencies, mean, and standard

deviation of items. Omega and alpha estimates of reliability were calculated using the

'MBESS' package in R. Multivariate binary logistic regression models were used to show

independent variables predicting self-reported behavioural responses to DTCA, and

subsequently to reveal the factors determining self-reported behavioural outcomes. The

outcomes of the logistic regression analyses were presented as odds ratios (ORs) with 95%

confidence intervals (CIs). Predictive accuracy and overall appropriateness of the models

were examined by non-significant ($p > 0.05$) Hosmer–Lemeshow tests[91] and significant ($p <$

0.01) Omnibus test of model coefficients.

RESULTS

Sample characteristics

The demographics of the sample are presented in Table 1.

Table 1

Demographics of the Sample (n=2057)

Variable	Frequency (%)	Mean	S.D.
Age (yr) (Continuous variable)		44.21	17.6
Education			…
No secondary schooling	61 (3.0)		
School examinations only	165 (8.0)		
School certificate examination only	355 (17.3)		
University entrance/ Matriculation only	277 (13.5)		
Technical or trade certificates	329 (16.0)		
Professional training	215 (10.5)		
University qualifications	655 (31.8)		
Ethnicity			…

11

NZ European	1290 (62.7)
Maori	218 (10.6)
Chinese	74 (3.6)
Indian	79 (3.8)
Pacific Islands	68 (3.3)
'Other' Ethnicities	328 (15.9)

Gender	…
Male	1001 (48.7)
Female	1056 (51.3)

Income	…
Less than $20,000	199 (9.7)
$20,000 to $39,999	460 (22.4)
$40,000 to $59,999	413 (20.1)
$60,000 to $79,999	338 (16.4)
$80,000 to $99,999	212 (10.3)
$100,000 to $119,999	202 (9.8)
Over $120,000	232 (11.3)

Occupation	…
Working for someone else full time	684 (33.3)
Working for someone else part time	275 (13.4)
Self-employed	166 (8.1)
Temporarily unemployed	144 (7.0)
Retired	337 (16.4)
Student	273 (13.3)
Full-time homemaker	178 (8.7)

12

Table 2 shows the means and standard deviations for non-demographic independent variables.

Table 2

Non-demographic independent variables

Items	Mean (SD)
Only drugs that are completely safe can be advertised in NZ	3.28 (1.18)
Only drugs that are extremely effective can be advertised in NZ	3.11 (1.12)
Overall, I believe that advertising of medicine is good for consumers	3.00 (1.02)
Overall, I consider advertising a good thing	3.07 (0.92)
Self-reported health status	5.98 (2.47)
Materialism	48.89 (9.32)
Searching online health information	0.71 (0.82)

60% of respondents considered themselves in good health. 5.2% were completely satisfied with their overall health, 25% were dissatisfied, and only 3.4% were completely dissatisfied with their overall health. 48% had looked for medical information online. Almost a third of the sample (30.7%) believed that DTCA was helpful for consumers, 43.7% thought that only drugs that are completely safe could be advertised, and 35.3% believed that only drugs that are extremely effective could be advertised. Moreover, as a result of seeing DTCA, 11.4% of participants asked their physicians for a prescription, 15.9% asked their physicians for more information, 34.4% searched the internet for more information and 16.2% asked their pharmacists for more information.

13

Predictors of self-reported behavioural outcomes

Results of the logistic regression analyses predicting each self-reported behavioural

outcomes are shown in Table 3.

Table 3

Summary of multivariate binary logistic regression models predicting self-reported DTCA-

triggered behaviours

Variable	Asking a doctor for a prescription: OR (95% CI)	Asking a doctor for more information about an illness: OR (95% CI)	Searching the Internet for more information regarding an illness: OR (95% CI)	Asking a pharmacist for more information about a drug: OR (95% CI)
Age	1.00 (0.99-1.01)	1.02 (1.01-1.03)***	1.01 (0.99-1.02)	1.01 (1.004-1.03)**
Annual Income	0.89 (0.81-0.97)*	0.89 (0.82-0.96)**	0.99 (0.93-1.05)	0.91 (0.84-0.98)*
Ethnicity New Zealand European (Reference)	1.00	1.00	1.00	1.00
Maori	1.33 (0.84-2.10)	1.76 (1.19-2.60)**	1.08 (0.77-1.52)	2.06 (1.41-3.01)***
Chinese	2.23 (1.14-	1.99 (1.04-	1.22 (0.71-2.08)	2.55 (1.40-

	4.39)*	3.80)*		4.63)**
Indian	5.00 (2.81-8.91)***	3.88 (2.21-6.81)***	1.58 (0.93-2.67)	1.77 (0.96-3.25)
Pacific Island	0.87 (0.39-1.96)	1.29 (0.64-2.58)	1.08 (0.62-1.87)	1.64 (0.86-3.15)
'Other' Ethnicities	1.24 (0.80-1.91)	1.35 (0.94-1.95)	1.28 (0.96-1.70)	1.78 (1.27-2.50)**
Gender	0.74 (0.53-1.02)	0.81 (0.61-1.07)	1.36 (1.09-1.70)**	1.08 (0.82-1.42)
Self-Reported Health Status	0.94 (0.89-0.99)*	0.93 (0.89-0.98)**	0.90 (0.86-0.93)***	0.94 (0.90-0.99)*
Occupation				
Unemployed (reference)	1.00	1.00	1.00	1.00
Working Fulltime	0.89 (0.52-1.55)	0.94 (0.57-1.54)	1.46 (0.94-2.26)	1.18 (0.71-1.95)
Working Part-Time	0.68 (0.37-1.26)	0.78 (0.45-1.34)	1.13 (0.71-1.82)	0.74 (0.42-1.29)
Self-Employed	1.05 (0.53-2.06)	0.52 (0.27-1.002)	1.07 (0.63-1.82)	0.99 (0.53-1.84)
Retired	0.67 (0.34-1.34)	0.57 (0.32-1.03)	1.10 (0.66-1.84)	0.77 (0.43-1.39)
Student	0.48 (0.24-0.96)*	1.10 (0.61-2.00)	1.52 (0.92-2.52)	0.77 (0.41-1.44)
Fulltime Homemaker	0.81 (0.41-1.59)	0.57 (0.30-1.09)	0.93 (0.55-1.56)	0.95 (0.52-1.74)
Level of Education	0.89 (0.82-0.96)**	0.96 (0.89-1.03)	0.99 (0.93-1.05)	1.03 (0.96-1.10)

Attitude toward Advertising (in general)	1.01 (0.85-1.19)	1.09 (0.94-1.26)	1.09 (0.97-1.23)	1.15 (0.99-1.33)
Attitude toward DTCA	1.61 (1.35-1.91)***	1.53 (1.31-1.77)***	1.34 (1.19-1.51)***	1.39 (1.21-1.61)***
Materialism	1.03 (1.01-1.05)***	1.01 (0.99-1.03)	1.02 (1.01-1.03)**	1.005 (0.99-1.02)
Searching Online Health Info	1.32 (1.11-1.57)**	1.67 (1.44-1.93)***	2.35 (2.08-2.65)***	1.32 (1.14-1.53)***
View on Effectiveness of Advertised Drugs	1.19 (0.96-1.48)	1.06 (0.88-1.28)	1.02 (0.88-1.18)	1.04 (0.87-1.24)
View on Safety of Advertised Drugs	0.87 (0.71-1.07)	0.90 (0.75-1.07)	0.94 (0.81-1.08)	1.02 (0.86-1.21)

Note: Materialism was measured as a total score

*$p < 0.05$ **$p < 0.01$ ***$p < 0.001$

Having asked a physician for a prescription after seeing a drug advertisement was predicted by higher materialism (OR: 1.03; 95% CI: 1.01 to 1.05, $p < 0.001$), a more positive attitude towards DTCA (OR: 1.61; 95% CI: 1.35 to 1.91, $p < 0.001$), and using the Internet to search for health information (OR: 1.32; 95% CI: 1.11 to 1.57, $p < 0.01$), in addition to poorer self-reported health status (OR: 0.94; 95% CI: 0.89 to 0.99, $p < 0.05$), less education (OR: 0.89; 95% CI: 0.82 to 0.96, $p < 0.01$), and lower income (OR: 0.89; 95% CI: 0.81 to 0.97, $p < 0.05$). Students (OR: 0.48; 95% CI: 0.24 to 0.96, $p < 0.05$) were less likely to ask a physician for a prescription than were unemployed respondents. Indian (OR: 5.00; 95% CI: 2.81 to 8.91, $p < 0.001$) and Chinese (OR: 2.23; 95% CI: 1.14 to 4.39, $p < 0.05$) respondents

were more likely to ask their physicians for a prescription, relative to New Zealand Europeans. This model correctly classified the outcome for 89% of the cases and explained 14.3% (Nagelkerke R^2) of the variation in asking a doctor for a prescription. The non-significant result of Hosmer–Lemeshow test ($\chi^2 = 4.78$, d.f. = 8, $p = 0.78$), and the significant result of Omnibus Tests of Model Coefficients ($p < 0.001$), revealed that the model had a good fit to the data.

Having asked a physician about an illness after seeing a drug advertisement was predicted by older age (OR: 1.02; 95% CI: 1.01 to 1.03, $p < 0.001$), a more positive attitude towards DTCA (OR: 1.53; 95% CI: 1.31 to 1.77, $p < 0.001$), and using the Internet to search for health information (OR: 1.67; 95% CI: 1.44 to 1.93, $p < 0.001$), as well as poorer self-reported health status (OR: 0.93; 95% CI: 0.89 to 0.98, $p < 0.01$), and lower income (OR: 0.89; 95% CI: 0.82 to 0.96, $p < 0.01$). Maori (OR: 1.76; 95% CI: 1.19 to 2.60, $p < 0.01$), Chinese (OR: 1.99; 95% CI: 1.04 to 3.80, $p < 0.05$), and Indian (OR: 3.88; 95% CI: 2.21 to 6.81, $p < 0.001$) respondents were more likely to ask their physicians for information about an illness than were New Zealand Europeans. This model correctly classified the outcome for 84.2% of the cases and explained 14.5% (Nagelkerke R^2) of the variation in asking a doctor about an illness. The non-significant result of Hosmer–Lemeshow test ($\chi^2 = 10.22$, d.f. = 8, $p = 0.25$), and the significant result of Omnibus Tests of Model Coefficients ($p < 0.001$) again showed a good model fit.

Having searched the Internet for more information regarding an illness after seeing a drug advertisement was predicted by higher materialism (OR: 1.02; 95% CI: 1.01 to 1.03, $p < 0.01$), more positive attitude towards DTCA (OR: 1.34; 95% CI: 1.19 to 1.51, $p < 0.001$), and using the Internet (OR: 2.35; 95% CI: 2.08 to 2.65, $p < 0.001$), along with poorer self-reported health status (OR: 0.90; 95% CI: 0.86 to 0.93, $p < 0.001$). Women (OR: 1.36; 95% CI: 1.09 to 1.70, $p < 0.01$) were more likely than men to search the Internet for more

information regarding an illness after exposure to DTCA. This model correctly classified the

outcome for 71.3% of the cases and explained 20.7% (Nagelkerke R^2) of the variation in

searching the Internet for more information regarding an illness. The non-significant result of

Hosmer–Lemeshow test ($\chi^2 = 20.03$, d.f. = 8, $p = 0.01$), and the significant result of Omnibus

Tests of Model Coefficients ($p < 0.001$) showed a good fit.

Having asked a pharmacist for more information about an advertised drug after seeing

a drug advertisement was predicted by older age (OR: 1.01; 95% CI: 1.004 to 1.03, $p < 0.01$),

more positive attitude towards DTCA (OR: 1.39; 95% CI: 1.21 to 1.61, $p < 0.001$), and using

the Internet (OR: 1.32; 95% CI: 1.14 to 1.53, $p < 0.001$), as well as poorer self-reported

health status (OR: 0.94; 95% CI: 0.90 to 0.99, $p < 0.05$) and lower income (OR: 0.91; 95%

CI: 0.84 to 0.98, $p < 0.05$). Maori (OR: 2.06; 95% CI: 1.41 to 3.01, $p < 0.001$), Chinese (OR:

2.55; 95% CI: 1.40 to 4.63, $p < 0. 01$), and 'other' ethnicities (OR: 1.78; 95% CI: 1.27 to

2.49, $p < 0.01$) were more likely than New Zealand European respondents to ask pharmacists

for more information about an advertised drug. This model correctly classified the outcome

for 83.9% of the cases and explained 10.2% (Nagelkerke R^2) of the variation in asking a

pharmacist for more information about an advertised drug. Model fit was again good with a

non-significant result of Hosmer–Lemeshow test ($\chi^2 = 7.01$, d.f. = 8, $p = 0.53$), and

significant result of Omnibus Tests of Model Coefficients ($p < 0.001$).

DISCUSSION

Individuals lacked knowledge regarding the regulation and safety of drug advertising

with nearly half of all participants believing that only drugs that are completely safe could be

advertised. Similarly, a substantial proportion thought that only drugs that are extremely

effective could be advertised. Individuals are often vulnerable to misinformation,[92] and do not

try to process the rest of the provided information if a drug advertisement presents a drug as

effective.[29] Inaccurate positive belief regarding the safety and efficacy of advertised drugs is concerning given that advertising may induce unwarranted inferences and change individuals' beliefs over time,[93] the main goal of drug advertising is to persuade rather than to inform,[94 95] and research shows that drug advertising is usually effective at persuasion.[96 97] Furthermore, some drugs that are advertised directly to consumers have serious side effects. For instance, Vioxx® (rofecoxib) was heavily advertised for five years in more than 80 countries, including New Zealand. It was subsequently withdrawn from the worldwide market in 2004 over safety concerns about increased risk of heart attack and stroke.[98-100]

Participants reported responding to drug advertising by seeking the medication or further information as a result of seeing a drug advertisement, indicating a general effect of DTCA. Such reported behaviour can have varied outcomes; requesting a prescription drug may lead to either appropriate treatment or inappropriate and excessive prescribing.[8] Moreover, searching or asking for more information can increase individuals' awareness of medical conditions and potential treatments, but it can also lead to seeking medications for irrelevant, non-medical, or minor medical problems.[101] Discussions about inappropriate drugs or unrelated medical conditions can take time away from necessary medical examinations, or prevent communications regarding healthy lifestyle changes or mental health issues, which can consequently influence patients' well-being.[94 102] Furthermore, finding reliable information on the internet is challenging "(like finding a needle in a haystack), and the noise of DTCA just makes the haystack larger" (p. 0286).[8]

Of importance, this study found disparities in self-reported behavioural responses to drug advertising with 'vulnerable' or 'at risk' individuals (i.e. poorer subjective health status, older, less educated, lower income, and ethnic minorities) being more likely to report responses to drug advertising. In particular, respondents who had lower levels of satisfaction with their health status were more likely than other individuals to report engaging in all four

behavioural responses. Older individuals were also more likely than others to seek more

information from a physician or pharmacist as a result of seeing a drug advertisement. While

health issues and associated needs for prescriptions might explain self-reported behavioural

responses of older individuals and those who were less satisfied with their health status, other

individuals classed as 'vulnerable' due to social determinants were also more likely to

respond to drug advertising. Respondents with lower levels of education were more likely to

ask a physician for a prescription. Those with lower levels of income were more likely to

report all behavioural responses except for searching the Internet, and unemployed

respondents were more likely than students to ask a physician for a prescription.

Respondents' ethnicity also influenced self-reported behavioural responses, so that ethnic

minorities were more likely to report behavioural responses. Taken together, the current

findings showed communication inequalities in response to drug advertising with

'vulnerable' or 'at risk' individuals being more likely to respond to such advertising. These

findings are consistent with the structural influence model of health communication, which

suggests that differences in health behaviours among different social groups can be explained

by focusing on how social determinants are linked to health communication outcomes.[9 103]

The imbalance in self-reported behavioural responses of 'at risk' individuals raises concerns

regarding the ethicality of drug advertising in its present form. Although physicians play the

role of gatekeepers and moderate the effects of drug advertising on individuals, patients'

requests can drive physicians' medication choices.[26] Many physicians have reported that

assuring patients that a requested medication is not suitable is challenging and onerous. [104]

In the current study, a favourable attitude towards drug advertising predicted all self-

reported behavioural outcomes. The fact that individuals might respond to drug advertising

based on their favourable attitudes, coupled with the fact that participants had inaccurate

knowledge regarding the safety and effectiveness of advertised drugs, suggests individuals

are at risk of being influenced by the promotional nature of the advertisements. This is a

significant concern since drug advertising is self-regulated in New Zealand[4][105] and medicine

advertisements often present patient success stories, which can mislead the public.[106] This

risk is further evident by the finding that materialism positively predicted self-reported

behavioural responses to DTCA, including asking a physician for a prescription, and

searching the internet for more information. Previous studies have revealed materialism is

associated with lower psychological well-being, more physical symptoms, more drug use,

more attention to advertising, as well as purchasing behaviour.[48][50-62] The current findings

linking materialism to responding to drug advertising align with earlier research showing

materialism is closely related to excessive and uncontrollable shopping and compulsive

consumption.[52][60-62] These outcomes add to this body of research by suggesting materialistic

individuals might be more likely than others to treat prescription drugs similarly to other

consumer goods. Of note, reliance on the Internet for medical information also predicted all

self-reported behavioural responses to DTCA. Thus, pharmaceutical companies could

improve the ethicality of their advertising by utilizing the Internet to develop patient support

and offer informative online DTCA, which can help people to have more effective

discussions with health professionals.

Limitations and Strengths

The current findings were based on cross-sectional data, thus causal inferences could

not be made. Future longitudinal studies could further explore the effects of social

determinants, personal characteristics, and exposure to drug advertisements on health

communication outcomes, including prescription drug purchasing. Moreover, the findings

were based on self-reported behavioural responses and might not reflect individuals' actual

behavioural responses. Experimental studies should be conducted to extend the outcomes and

21

contributions of this study. Since this study focussed on perceived behavioural responses, perceptions of the informativeness of DTCA and motivations for responding to DTCA were not explored and could be examined in future research.

The outcomes from our large representative sample can be generalized to national population in New Zealand and have important implications for both healthcare policy makers and pharmaceutical companies. This research suggests that regulations on drug advertising should be tightened. Moreover, health policymakers should increase knowledge regarding drug advertising and let individuals know that advertised medications are not necessarily safe and effective. Health policymakers can also concentrate on people's attitudes towards advertising of prescription drugs, and let them know that it is a paid promotion conveyed by pharmaceutical companies. Health professionals need to be well informed of all medications prior to them being advertised to help individuals make safe choices. Furthermore, pharmaceutical companies should advertise their medications responsibly and educate individuals about treatments constructively since people, especially those who are more vulnerable, may ask for a medication that they do not need. Drug advertisements can discuss lifestyle alternatives to taking drugs and state that there are other medications available, which may have the identical effects.

CONCLUSIONS

While much attention has been paid to perceived behavioural responses to drug advertising, to the best of our knowledge, no study has documented 'at risk' individuals' perceived behavioural responses to drug advertising. This study, therefore, grounded in communication inequality and the structural influence model, presented the factors predicting individuals' self-reported behavioural responses to drug advertising. This research found that 'at risk' individuals were more vulnerable to drug advertising as supported by the

22

representative empirical findings. Furthermore, the outcomes revealed the importance of

attitudes towards DTCA over and above knowledge of regulation and safety of advertised

drugs, which can leave individuals vulnerable to drug advertising and at risk of making

uninformed decisions accordingly. The current research also addressed the important

question of whether materialism has effects on self-reported behavioral responses to drug

advertising and revealed that respondents higher in materialism were more likely to be

affected by drug advertising, suggesting they might pay more attention to advertisements, or

DTCA might be appealing to their consumerism, a trait that is associated with lower

psychological well-being.[59]

Taken together, the outcomes suggest drug advertising affects the most 'at risk'

individuals, who base their decisions on their attitudes, who are motivated to consume, and

who rely on the Internet for medical information. The findings raise significant concerns

regarding ethicality of DTCA and suggest a need for policy developments to ensure

medicine advertisements are ethical and do not cause misuse or overuse of medications.

Ethics approval This study had ethics approval from the University of Otago, and all

participants gave their written consent.

Data sharing statement The authors agree to facilitate access to the data for non-commercial

research purposes.

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29

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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	1-2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-7
Objectives	3	State specific objectives, including any prespecified hypotheses	4-7
Methods			
Study design	4	Present key elements of study design early in the paper	7-9
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	7-8
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	7-8
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	8-9
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	8-9
Bias	9	Describe any efforts to address potential sources of bias	7-8
Study size	10	Explain how the study size was arrived at	7-8
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	8-9
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	9-10
		(*b*) Describe any methods used to examine subgroups and interactions	9-10
		(*c*) Explain how missing data were addressed	No missing data
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	NA
		(*e*) Describe any sensitivity analyses	NA
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	7-8
		(b) Give reasons for non-participation at each stage	NA
		(c) Consider use of a flow diagram	NA
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	10-12
		(b) Indicate number of participants with missing data for each variable of interest	NA
Outcome data	15*	Report numbers of outcome events or summary measures	10-17
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	13-17
		(*b*) Report category boundaries when continuous variables were categorized	NA
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	NA
Discussion			
Key results	18	Summarise key results with reference to study objectives	17-21
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	20-21
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	17-22
Generalisability	21	Discuss the generalisability (external validity) of the study results	21
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	22

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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'At risk' individuals' responses to direct to consumer advertising of prescription drugs: A nationally representative cross-sectional study

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'At risk' individuals' responses to

direct to consumer advertising of prescription drugs:

A nationally representative cross-sectional study

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1

ABSTRACT

Objectives: The factors determining individuals' self-reported behavioural responses to direct to consumer advertising of prescription drugs were explored with an emphasis on 'at risk' individuals' responses.

Design: Nationally representative cross-sectional survey.

Setting: Community living adults in New Zealand.

Participants: 2057 adults (51% female).

Primary outcome measures: Self-reported behavioural responses to drug advertising (asking a physician for a prescription, asking a physician for more information about an illness, searching the Internet for more information regarding an illness, and asking a pharmacist for more information about a drug).

Methods: Multivariate logistic regressions determined whether participants' self-reported behavioural responses to drug advertising were predicted by attitudes towards advertising and drug advertising, judgements about safety and effectiveness of advertised drugs, self-reported health status, materialism, online search behaviour, as well as demographic variables.

Results: Identifying as Indian, and to a less extent Chinese, Māori, and 'other' ethnicities were the strongest predictors of one or more self-reported responses (ORs: 1.76-5.00, ps <0.05). Poorer self-reported health status (ORs: 0.90-0.94, all $ps < 0.05$), favourable attitude towards drug advertising (ORs: 1.34-1.61, all $ps < 0.001$), and searching for medical information online (ORs: 1.32-2.35, all $ps < 0.01$) predicted all self-reported behavioural outcomes. Older age (ORs: 1.01-1.02, $ps < 0.01$), less education (OR: 0.89, $p < 0.01$), lower income (ORs: 0.89-0.91, $ps < 0.05$), and higher materialism (ORs: 1.02-1.03, $ps < 0.01$) also predicted one or more self-reported responses.

2

Conclusions: Taken together, the findings suggest individuals, especially those who are 'at risk' (i.e. with poorer self-reported health status, older, less educated, lower income, and ethnic minorities) may be more vulnerable to drug advertising and may make uninformed decisions accordingly. The outcomes raise significant concerns relating to the ethicality of drug advertising and suggest a need for stricter guidelines to ensure that drug advertisements provided by pharmaceutical companies are ethical.

Keywords: Direct to consumer advertising; Prescription drugs; Self-reported behavioural responses to drug advertising; Structural influence model of health communication; 'At risk' individuals

ARTICLE SUMMARY

Strengths and limitations of this study

- A strength of this study is the use of the large and representative sample so that the findings can be generalized to the national population of New Zealand.

- This is the first study to explore the factors determining individuals' self-reported behavioural responses to direct to consumer advertising of prescription drugs in New Zealand and at a population level.

- The present study shows, for the first time, the responses of ethnic minorities to drug advertising outside of North America.

- The cross-sectional study does not explore the causal relationships between dependent and independent variables.

- The findings of this study were based on self-reported behavioural responses to drug advertising and might not reflect individuals' actual behavioural responses.

INTRODUCTION

Direct to consumer advertising (DTCA) of prescription drugs is a controversial

pharmaceutical marketing strategy.[1] Currently, it is only legal in New Zealand and the USA,

[2-6] although advertising on the internet can cross geographical boundaries and the European

Commission has considered a proposal for drug advertising.[7] A health communication tool

such as DTCA can have positive or negative consequences.[8] The outcomes of DTCA depend

on the types of advertised drugs and the nature of the illnesses to be treated. "DTCA is most

likely to deliver public health benefits when the condition to be treated is serious and when

the treatment is safe, effective, and underused. However, DTCA will tend to deliver net

harms when the condition is mild or trivial and when the treatment is potentially dangerous,

marginally effective, or overused" (p. 0286).[8] Furthermore, the effect of DTCA varies

depending on how individuals interpret and respond to the information. Of concern, the vast

and disparate information in drug advertising reaches individuals directly and poses

challenges to individuals to make informed choices on whether the advertised drugs will be

beneficial or deleterious.[9] Supporters of drug advertising claim that it improves individuals'

autonomy by increasing awareness of medical problems, symptoms, and existing treatments;

accordingly, it can assist patients to make superior medical decisions.[4 10-13] However,

exposure to health information through DTCA does not necessarily lead to knowledge[12] and

can result in individuals requesting a drug that they do not actually need.[14] Studies show that

individuals typically understand the benefits far better than the risks.[15] Furthermore, new

drugs presented in DTCA may have unknown side effects or safety issues.[16] Opponents of

DTCA argue that the primary motive of the pharmaceutical industry is to increase profit

rather than to help individuals make informed health-related decisions.[17-20]

The pharmaceutical industry spends billions of dollars annually on promotion[21] to

push consumers to buy the advertised medications, spending more on promotion than

4

research and development.[22] Such advertising has been blamed for changing the pattern of use of healthcare services,[23] including medicalising normal human conditions,[23] driving overconsumption of new prescription drugs and motivating requests for more expensive medications.[5 24] For instance, in countries with a socialised health system, such as New Zealand, where the government subsidises generic drugs, advertising can convince patients to request a non-subsidised branded medication over a subsidised generic one. The prescription charge for each subsidised medication is $5, whereas there may be an additional (sometimes substantial) cost if the drug is not fully subsidised.[25] Prescription drugs must be prescribed by physicians, and medical professionals act as gatekeepers between DTCA and individuals. However, as a result of drug advertising, patients may pressure physicians to prescribe the advertised branded drugs, and patients' requests for specific drugs significantly increase the likelihood that requested drugs are prescribed.[8 26 27] Physicians also report that DTCA negatively influences the physician-patient relationship because patients challenge their knowledge based on information they have received through drug advertising.[28 29] The interference in the physician-patient relationship can result in ill-informed patients and treatments that are not fully tailored to the patients' conditions.[30] Consequently, the question arises as to whether individuals are able to make informed decisions in response to drug advertising.

There is a lack of research examining possible communication disparities in response to drug advertising,[31] and researchers have suggested the need for detailed examinations of responses of various social groups.[9] Models of drug advertising commonly assume identical attention, processing, and behaviour among individuals. However, if the information is not suitably fitted to individuals' needs and knowledge, it can limit their ability to make informed decisions instead of strengthening it.[32] The structural influence model (SIM) of health communication suggests that social determinants are linked to health communication

5

outcomes and theorises that health communication disparities can be seen in terms of

inequalities in how people act on heath information.[33] Similarly, there might be disparities in

individuals' responses to drug advertising. Assuming that there might be differences between

social groups in their ability to process and respond to drug advertising, it is important to

understand the outcomes of exposure to DTCA between different social groups.[9] The current

study, therefore, explored whether there were communication disparities in self-reported

behavioural responses to DTCA, focussing in particular on 'at-risk' individuals' responses.

In healthcare, the terms 'vulnerable' or potentially 'at-risk' are used to refer to

individuals who are ethnic minorities, children, elderly, those with certain medical

conditions, as well as socioeconomically disadvantaged individuals, such as those with a

lower level of education and/or a lower level of income.[34-36] 'At risk' individuals are more

likely to experience a medical information gap. For instance, older individuals are more

vulnerable to DTCA than are younger individuals because they tend to obtain less

information from the advertisements[30] and are more likely to misinterpret information on the

effectiveness of advertised drugs.[37] The misinterpretation of a drug's effectiveness can

complicate the physician-patient relationship if the patient requests the advertised drug.[37]

While younger adults might also misinterpret information in DTCA, older adults are more

likely to have several medical conditions requiring more prescription drugs and are therefore

more likely to be effected by communication gaps in drug advertisements.[30] Less educated

and lower income individuals may obtain less information from drug advertisement and may

be more vulnerable than others to the medication information gap.[30] People with poorer

health may similarly be more vulnerable to drug advertising as they have also been defined as

vulnerable populations in the medical domain[34 35] and they may need to use more prescription

drugs. Furthermore, research typically shows health outcomes for ethnic minorities are poorer

compared to the majority populations.[35 36 38-40] For example, earlier research has reported

dissimilarities in health outcomes of different ethnicities in the United States and New

Zealand. In both countries, poorer health outcomes were found among the minority

populations. Ethnic minorities can, therefore, be considered as vulnerable or 'at risk'

people.[39] Given the growing concern about the role of health literacy and social imbalance in

health-related outcomes, more studies have to be conducted to map the paths between social

determinants and health-related consequences.[41 42] Drawing on the structural influence model

of health communication, the present study explored whether there was any social imbalance

as a function of individual characteristics with regards to responding to drug advertising.

Using a representative sample within New Zealand, this study examined whether 'at risk'

individuals (with poorer self-reported health status, older, less educated, lower income, lower

occupational status, and ethnic minorities) were more likely to be influenced by drug

advertising.

Research has also focused on the role of attitudes and personal characteristics in

determining responses to advertising. Positive attitudes towards drug advertising predict

behavioural intentions and responses to such advertising.[43-45] Thus, the present study

examined the influence of attitudes toward advertising and DTCA on perceived behavioural

responses to drug advertising. In addition, this study explored the personal trait of

materialism to examine whether there was a relationship between materialistic traits and

responding to drug advertising. Materialism emphasizes the importance placed on goods and

their purchase to help achieve desired goals or situations.[46] Drug advertising uses emotional

appeals, for instance showing a character in a fearful state, followed by a happy state after

using the product, to communicate that purchasing the product is a way to overcome

insecurity.[47] The association between feelings of insecurity and materialistic behavior was

discussed as early as the 1950's.[48] Materialism is also linked with poorer health status

including physical symptoms, drug use,[49 50] and lower subjective well-being.[51-57] Considering

7

the nature of advertising, coupled with materialistic individuals' greater attention to advertising,[58] proneness to compulsive consumption,[52 59-62] and susceptibility to advertising,[54] it is reasonable to speculate that materialistic individuals might be more likely to respond to DTCA, especially given that DTCA markets drugs to individuals in the same fashion as other fast moving consumer goods. However, no previous research has explored the relationships between materialism and responses to drug advertising. Therefore, the current study examined the effects of materialism on self-reported behavioural responses to drug advertising. In addition, people are increasingly searching for medical information on the Internet,[63] but this may differ by education, income, and ethnicity. These inequalities in Internet usage may intensify health inequalities among different groups.[64-66] Therefore, this study also examined the influence of the use of the Internet to search for medical information on self-reported behavioural responses to drug advertising.

METHODS

Source of Data

This study analysed a subset of pharmaceutical and health-related questions from a large online survey covering a range of attitudes, behaviour, consumption, and lifestyle questions. Data collection was performed in late 2013 by Research Now, a leading market research company operating in more than 40 countries with over 11 Million panelists. Quota sampling was used for selecting the survey participants. The instructions were that the respondents were to be demographically representative of the New Zealand population in terms of age, sex, education, ethnicity, and income. The full survey instrument took approximately 40 minutes to complete. 2057 usable responses were retained for analysis. Since an independent panel survey was used, it was not possible to calculate a response rate (participants were signed up to complete the surveys that they were sent). All participants

answered all of the questions used in this study since the questions were not based on a

response logic of any earlier item in the questionnaire. This study had ethics approval from

the University of Otago, and all participants gave their written consent.

Variables

Dependent variables

Perceived effects of DTCA on individuals were measured by asking participants to

report their behavioural responses after exposure to a drug advertisement through four yes/no

questions drawn from previous studies: 1) As a result of seeing an advertisement for a drug

have you asked your physician for a prescription?[67] 2) As a result of seeing an advertisement

for a drug have you asked your physician for more information about an illness?[67] 3) As a

result of seeing an advertisement for a drug have you searched the internet for more

information regarding an illness?[68] 4) As a result of seeing an advertisement for a drug, have

you asked your pharmacist for more information about a drug?[67]

Independent variables (predictors)

Measures of attitudes and knowledge were made on a 5-point Likert scale from 1

(strongly disagree) to 5 (strongly agree). Participants were asked about their general attitude

toward advertising,[69] attitude toward DTCA,[45 70] knowledge about the safety of advertised

drugs,[71 72] and knowledge about the effectiveness of drugs.[72] Self-reported/subjective health

status, a valid and widely used indicator of health conditions,[73-76] was measured by asking

respondents' self-rated satisfaction with their health on a 10-point Likert scale from 1

(completely dissatisfied) to 10 (completely satisfied).[71] Materialism was measured by using

Richins and Dawson's Materialism Value Scale, including eighteen statements on a 5-point

Likert scale from 1 (strongly disagree) to 5 (strongly agree).[46] Richins and Dawson's scale

9

has been widely used in consumer research,[47 77-80] and shown robust psychometric properties

in international research.[47 81] This scale was originally argued to have three subscales

(centrality, happiness, success), but this dimensional structure is not consistently found in the

data.[82 83] In this study, the EFA/CFA found evidence for a 2-factor model, but with all the

negatively worded items loading on the second factor, suggesting that this factor is an

artefactual factor, based on the positive or negative wording of items, rather than a real latent

dimension.[84 85] Moreover, previous research has revealed that although there are three

dimensions in the original scale, items can be summed to reflect an overall materialism

score.[86] Accordingly, in line with common practice, a total materialism score was

computed.[86-90] Based on omega and alpha estimates, the internal consistency (reliability) of

the scale was good ($\omega = 0.81$ [95% C.I. 0.80, 0.82], $\alpha=0.81$ [0.80, 0.82]). Use of the Internet

to search for medical information was measured by the sum of two yes/no items; i.e.

searching for medical advice online, and visiting a health related blog ($\omega = 0.72$ [0.70, 0.74],

$\alpha=0.70$ [0.67, 0.72]). Demographic information on age (as a continuous variable), gender,

ethnicity (as multiple dummy variables, with New Zealand European as the reference level),

education, income, and occupation (as multiple dummy variables, with unemployed as the

reference level) were also used.

Data Analysis

Data were analysed with IBM SPSS Statistics for Windows, Version 22.0, Armonk,

NY: IBM Corp. Descriptive statistics were used to calculate frequencies, mean, and standard

deviation of items. Omega and alpha estimates of reliability were calculated using the

'MBESS' package in R. Multivariate binary logistic regression models were used to show

independent variables predicting self-reported behavioural responses to DTCA, and

subsequently to reveal the factors determining self-reported behavioural outcomes. The

outcomes of the logistic regression analyses were presented as odds ratios (ORs) with 95%

confidence intervals (CIs). Predictive accuracy and overall appropriateness of the models

were examined by non-significant ($p > 0.05$) Hosmer–Lemeshow tests[91] and significant ($p <$

0.01) Omnibus test of model coefficients.

RESULTS

Sample characteristics

The demographics of the sample are presented in Table 1.

Table 1

Demographics of the Sample (n=2057)

Variable	Frequency (%)	Mean	S.D.
Age (yr)		44.21	17.6
(Continuous variable)			
Education			…
No secondary schooling	61 (3.0)		
School examinations only	165 (8.0)		
School certificate examination only	355 (17.3)		
University entrance/ Matriculation only	277 (13.5)		
Technical or trade certificates	329 (16.0)		
Professional training	215 (10.5)		
University qualifications	655 (31.8)		
Ethnicity			…

11

NZ European	1290 (62.7)
Maori	218 (10.6)
Chinese	74 (3.6)
Indian	79 (3.8)
Pacific Islands	68 (3.3)
'Other' Ethnicities	328 (15.9)
<u>Gender</u>	…
Male	1001 (48.7)
Female	1056 (51.3)
<u>Income</u>	…
Less than $20,000	199 (9.7)
$20,000 to $39,999	460 (22.4)
$40,000 to $59,999	413 (20.1)
$60,000 to $79,999	338 (16.4)
$80,000 to $99,999	212 (10.3)
$100,000 to $119,999	202 (9.8)
Over $120,000	232 (11.3)
<u>Occupation</u>	…
Working for someone else full time	684 (33.3)
Working for someone else part time	275 (13.4)
Self-employed	166 (8.1)
Temporarily unemployed	144 (7.0)
Retired	337 (16.4)
Student	273 (13.3)
Full-time homemaker	178 (8.7)

12

Table 2 shows the means and standard deviations for non-demographic independent

variables.

Table 2

Non-demographic independent variables

Items	Mean (SD)
Only drugs that are completely safe can be advertised in NZ	3.28 (1.18)
Only drugs that are extremely effective can be advertised in NZ	3.11 (1.12)
Overall, I believe that advertising of medicine is good for consumers	3.00 (1.02)
Overall, I consider advertising a good thing	3.07 (0.92)
Self-reported health status	5.98 (2.47)
Materialism	48.89 (9.32)
Searching online health information	0.71 (0.82)

60% of respondents considered themselves in good health. 5.2% were completely

satisfied with their overall health, 25% were dissatisfied, and only 3.4% were completely

dissatisfied with their overall health. 48% had looked for medical information online. Almost

a third of the sample (30.7%) believed that DTCA was helpful for consumers, 43.7% thought

that only drugs that are completely safe could be advertised, and 35.3% believed that only

drugs that are extremely effective could be advertised. Moreover, as a result of seeing DTCA,

11.4% of participants asked their physicians for a prescription, 15.9% asked their physicians

for more information, 34.4% searched the internet for more information and 16.2% asked

their pharmacists for more information.

Predictors of self-reported behavioural outcomes

Results of the logistic regression analyses predicting each self-reported behavioural

outcomes are shown in Table 3.

Table 3

Summary of multivariate binary logistic regression models predicting self-reported DTCA-

triggered behaviours

Variable	Asking a physician for a prescription: OR (95% CI)	Asking a physician for more information about an illness: OR (95% CI)	Searching the Internet for more information regarding an illness: OR (95% CI)	Asking a pharmacist for more information about a drug: OR (95% CI)
Age	1.00 (0.99-1.01)	1.02 (1.01-1.03)***	1.01 (0.99-1.02)	1.01 (1.004-1.03)**
Annual Income	0.89 (0.81-0.97)*	0.89 (0.82-0.96)**	0.99 (0.93-1.05)	0.91 (0.84-0.98)*
Ethnicity				
New Zealand	1.00	1.00	1.00	1.00

European (Reference)				
Maori	1.33 (0.84-2.10)	1.76 (1.19-2.60)**	1.08 (0.77-1.52)	2.06 (1.41-3.01)***
Chinese	2.23 (1.14-4.39)*	1.99 (1.04-3.80)*	1.22 (0.71-2.08)	2.55 (1.40-4.63)**
Indian	5.00 (2.81-8.91)***	3.88 (2.21-6.81)***	1.58 (0.93-2.67)	1.77 (0.96-3.25)
Pacific Island	0.87 (0.39-1.96)	1.29 (0.64-2.58)	1.08 (0.62-1.87)	1.64 (0.86-3.15)
'Other' Ethnicities	1.24 (0.80-1.91)	1.35 (0.94-1.95)	1.28 (0.96-1.70)	1.78 (1.27-2.50)**
Gender	0.74 (0.53-1.02)	0.81 (0.61-1.07)	1.36 (1.09-1.70)**	1.08 (0.82-1.42)
Self-Reported Health Status	0.94 (0.89-0.99)*	0.93 (0.89-0.98)**	0.90 (0.86-0.93)***	0.94 (0.90-0.99)*
Occupation Unemployed (reference)	1.00	1.00	1.00	1.00
Working Fulltime	0.89 (0.52-1.55)	0.94 (0.57-1.54)	1.46 (0.94-2.26)	1.18 (0.71-1.95)
Working Part-Time	0.68 (0.37-1.26)	0.78 (0.45-1.34)	1.13 (0.71-1.82)	0.74 (0.42-1.29)
Self-Employed	1.05 (0.53-2.06)	0.52 (0.27-1.002)	1.07 (0.63-1.82)	0.99 (0.53-1.84)
Retired	0.67 (0.34-1.34)	0.57 (0.32-1.03)	1.10 (0.66-1.84)	0.77 (0.43-1.39)
Student	0.48 (0.24-	1.10 (0.61-2.00)	1.52 (0.92-2.52)	0.77 (0.41-1.44)

	0.96)*			
Fulltime Homemaker	0.81 (0.41-1.59)	0.57 (0.30-1.09)	0.93 (0.55-1.56)	0.95 (0.52-1.74)
Level of Education	0.89 (0.82-0.96)**	0.96 (0.89-1.03)	0.99 (0.93-1.05)	1.03 (0.96-1.10)
Attitude toward Advertising (in general)	1.01 (0.85-1.19)	1.09 (0.94-1.26)	1.09 (0.97-1.23)	1.15 (0.99-1.33)
Attitude toward DTCA	1.61 (1.35-1.91)***	1.53 (1.31-1.77)***	1.34 (1.19-1.51)***	1.39 (1.21-1.61)***
Materialism	1.03 (1.01-1.05)***	1.01 (0.99-1.03)	1.02 (1.01-1.03)**	1.005 (0.99-1.02)
Searching Online Health Info	1.32 (1.11-1.57)**	1.67 (1.44-1.93)***	2.35 (2.08-2.65)***	1.32 (1.14-1.53)***
View on Effectiveness of Advertised Drugs	1.19 (0.96-1.48)	1.06 (0.88-1.28)	1.02 (0.88-1.18)	1.04 (0.87-1.24)
View on Safety of Advertised Drugs	0.87 (0.71-1.07)	0.90 (0.75-1.07)	0.94 (0.81-1.08)	1.02 (0.86-1.21)

*$p < 0.05$ **$p < 0.01$ ***$p < 0.001$

Having asked a physician for a prescription after seeing a drug advertisement was most strongly predicted by identifying as Indian (OR: 5.00; 95% CI: 2.81 to 8.91, $p < 0.001$) or Chinese (OR: 2.23; 95% CI: 1.14 to 4.39, $p < 0.05$), followed by more positive attitudes towards DTCA (OR: 1.61; 95% CI: 1.35 to 1.91, $p < 0.001$). Searching for health information

online (OR: 1.32; 95% CI: 1.11 to 1.57, $p < 0.01$) was a moderate strength predictor. Weaker

predictors were higher materialism (OR: 1.03; 95% CI: 1.01 to 1.05, $p < 0.001$), poorer self-

reported health status (OR: 0.94; 95% CI: 0.89 to 0.99, $p < 0.05$), lower income (OR: 0.89;

95% CI: 0.81 to 0.97, $p < 0.05$), and less education (OR: 0.89; 95% CI: 0.82 to 0.96, $p <$

0.01). Students (OR: 0.48; 95% CI: 0.24 to 0.96, $p < 0.05$) were strongly less likely to report

asking a physician for a prescription than were unemployed respondents. This model

correctly classified the outcome for 89% of the cases and explained 14.3% (Nagelkerke R^2)

of the variation in asking a physician for a prescription. The non-significant result of

Hosmer–Lemeshow test ($\chi^2 = 4.78$, d.f. = 8, $p = 0.78$), and the significant result of Omnibus

Tests of Model Coefficients ($p < 0.001$), demonstrated that the model had a good fit to the

data.

Having asked a physician about an illness after seeing a drug advertisement was most

strongly predicted by identifying as Indian (OR: 3.88; 95% CI: 2.21 to 6.81, $p < 0.001$),

Chinese (OR: 1.99; 95% CI: 1.04 to 3.80, $p < 0.05$), or Māori (OR: 1.76; 95% CI: 1.19 to

2.60, $p < 0.01$), followed by searching for health information online (OR: 1.67; 95% CI: 1.44

to 1.93, $p < 0.001$), and more positive attitudes towards DTCA (OR: 1.53; 95% CI: 1.31 to

1.77, $p < 0.001$). It was weakly predicted by older age (OR: 1.02; 95% CI: 1.01 to 1.03, $p <$

0.001), poorer self-reported health status (OR: 0.93; 95% CI: 0.89 to 0.98, $p < 0.01$), and

lower income (OR: 0.89; 95% CI: 0.82 to 0.96, $p < 0.01$). This model correctly classified the

outcome for 84.2% of the cases and explained 14.5% (Nagelkerke R^2) of the variation in

asking a physician about an illness. The non-significant result of Hosmer–Lemeshow test (χ^2

= 10.22, d.f. = 8, $p = 0.25$), and the significant result of Omnibus Tests of Model Coefficients

($p < 0.001$) again showed a good model fit.

Having searched the Internet for more information regarding an illness after seeing a

drug advertisement was strongly predicted by searching for health information online (OR:

17

2.35; 95% CI: 2.08 to 2.65, $p < 0.001$), moderately predicted by more positive attitude

towards DTCA (OR: 1.34; 95% CI: 1.19 to 1.51, $p < 0.001$), and weakly predicted by higher

materialism (OR: 1.02; 95% CI: 1.01 to 1.03, $p < 0.01$), in addition to poorer self-reported

health status (OR: 0.90; 95% CI: 0.86 to 0.93, $p < 0.001$). Women were somewhat (OR: 1.36;

95% CI: 1.09 to 1.70, $p < 0.01$) more likely than men to report searching the Internet for more

information regarding an illness after exposure to DTCA. This model correctly classified the

outcome for 71.3% of the cases and explained 20.7% (Nagelkerke R^2) of the variation in

searching the Internet for more information regarding an illness. The non-significant result of

Hosmer–Lemeshow test ($\chi^2 = 20.03$, d.f. = 8, $p = 0.01$), and the significant result of Omnibus

Tests of Model Coefficients ($p < 0.001$) showed a good fit.

Having asked a pharmacist for more information about an advertised drug after seeing

a drug advertisement was most strongly predicted by identifying as Chinese (OR: 2.55; 95%

CI: 1.40 to 4.63, $p < 0.01$), Māori (OR: 2.06; 95% CI: 1.41 to 3.01, $p < 0.001$), or 'other'

ethnicities (OR: 1.78; 95% CI: 1.27 to 2.50, $p < 0.01$). More positive attitudes towards DTCA

(OR: 1.39; 95% CI: 1.21 to 1.61, $p < 0.001$) and searching for health information online (OR:

1.32; 95% CI: 1.14 to 1.53, $p < 0.001$) were moderate strength predictors. Weaker predictors

were older age (OR: 1.01; 95% CI: 1.004 to 1.03, $p < 0.01$), poorer self-reported health status

(OR: 0.94; 95% CI: 0.90 to 0.99, $p < 0.05$), and lower income (OR: 0.91; 95% CI: 0.84 to

0.98, $p < 0.05$). This model correctly classified the outcome for 83.9% of the cases and

explained 10.2% (Nagelkerke R^2) of the variation in asking a pharmacist for more

information about an advertised drug. Model fit was again good with a non-significant result

of Hosmer–Lemeshow test ($\chi^2 = 7.01$, d.f. = 8, $p = 0.53$), and significant result of Omnibus

Tests of Model Coefficients ($p < 0.001$).

DISCUSSION

18

Individuals lacked knowledge regarding the regulation and safety of drug advertising with nearly half of all participants believing that only drugs that are completely safe could be advertised. Similarly, a substantial proportion thought that only drugs that are extremely effective could be advertised. Individuals are often vulnerable to misinformation,[92] and do not try to process the rest of the provided information if a drug advertisement presents a drug as effective.[29] Inaccurate positive belief regarding the safety and efficacy of advertised drugs is concerning given that advertising may induce unwarranted inferences and change individuals' beliefs over time,[93] the main goal of drug advertising is to persuade rather than to inform,[94 95] and research shows that drug advertising is usually effective at persuasion.[96 97] Furthermore, some drugs that are advertised directly to consumers have serious side effects. For instance, Vioxx® (rofecoxib) was heavily advertised for five years in more than 80 countries, including New Zealand. It was subsequently withdrawn from the worldwide market in 2004 over safety concerns about increased risk of heart attack and stroke.[98-100]

Participants reported responding to drug advertising by seeking the medication or further information as a result of seeing a drug advertisement, indicating a general effect of DTCA. Such reported behaviour can have varied outcomes; requesting a prescription drug may lead to either appropriate treatment or inappropriate and excessive prescribing.[8] Moreover, searching or asking for more information can increase individuals' awareness of medical conditions and potential treatments, but it can also lead to seeking medications for irrelevant, non-medical, or minor medical problems.[101] Discussions about inappropriate drugs or unrelated medical conditions can take time away from necessary medical examinations, or prevent communications regarding healthy lifestyle changes or mental health issues, which can consequently influence patients' well-being.[94 102] Furthermore, finding reliable information on the internet is challenging "(like finding a needle in a haystack), and the noise of DTCA just makes the haystack larger" (p. 0286).[8]

19

Of importance, this study found disparities in self-reported behavioural responses to drug advertising with 'vulnerable' or 'at risk' individuals (i.e. poorer subjective health status, older, less educated, lower income, and ethnic minorities) being more likely to report responses to drug advertising. In particular, respondents' ethnicity influenced self-reported behavioural responses, so that some ethnic minorities were strongly more likely to report behavioural responses, relative to New Zealand Europeans. This study extends the handful of studies, which have examined responses of ethnic minorities to DTCA[103] and shows the disparate effects of drug advertising on vulnerable populations outside of North America. Respondents who had lower levels of satisfaction with their health status were more likely than other individuals to report engaging in all four behavioural responses. Older individuals were also more likely than others to seek more information from a physician or pharmacist as a result of seeing a drug advertisement. While health issues and associated needs for prescriptions might explain self-reported behavioural responses of older individuals and those who were less satisfied with their health status, other individuals classed as 'vulnerable' due to social determinants were also more likely to respond to drug advertising. Respondents with lower levels of education were more likely to ask a physician for a prescription. Those with lower levels of income were more likely to report all behavioural responses except for searching the Internet, and unemployed respondents were more likely than students to ask a physician for a prescription. Taken together, the current findings showed communication inequalities in response to drug advertising with 'vulnerable' or 'at risk' individuals being more likely to respond to such advertising. These findings are consistent with the structural influence model of health communication, which suggests that differences in health behaviours among different social groups can be explained by focusing on how social determinants are linked to health communication outcomes.[9 104] The imbalance in self-reported behavioural responses of 'at risk' individuals raises concerns regarding the ethicality

of drug advertising in its present form. Although physicians play the role of gatekeepers and moderate the effects of drug advertising on individuals, patients' requests can drive physicians' medication choices.[26] Many physicians have reported that assuring patients that a requested medication is not suitable is challenging and onerous. [105]

In the current study, a favourable attitude towards drug advertising predicted all self-reported behavioural outcomes. The fact that individuals might respond to drug advertising based on their favourable attitudes, coupled with the fact that participants had inaccurate knowledge regarding the safety and effectiveness of advertised drugs, suggests individuals are at risk of being influenced by the promotional nature of the advertisements. This is a significant concern since drug advertising is self-regulated in New Zealand[4 106] and medicine advertisements often present patient success stories, which can mislead the public.[107] This risk is further evident by the finding that materialism positively predicted self-reported behavioural responses to DTCA, including asking a physician for a prescription, and searching the internet for more information. Previous studies have revealed materialism is associated with lower psychological well-being, more physical symptoms, more drug use, more attention to advertising, as well as purchasing behaviour.[48 50-62] The current findings linking materialism to responding to drug advertising align with earlier research showing materialism is closely related to excessive and uncontrollable shopping and compulsive consumption.[52 60-62] These outcomes add to this body of research by suggesting materialistic individuals might be more likely than others to treat prescription drugs similarly to other consumer goods. Of note, reliance on the Internet for medical information also predicted all self-reported behavioural responses to DTCA. Thus, pharmaceutical companies could improve the ethicality of their advertising by utilizing the Internet to develop patient support and offer informative online DTCA, which can help people to have more effective discussions with health professionals.

21

Limitations and Strengths

The current findings were based on cross-sectional data, thus causal inferences could

not be made. Future longitudinal studies could further explore the effects of social

determinants, personal characteristics, and exposure to drug advertisements on health

communication outcomes, including prescription drug purchasing. Moreover, the findings

were based on self-reported behavioural responses and might not reflect individuals' actual

behavioural responses. Experimental studies should be conducted to extend the outcomes and

contributions of this study. Since this study focussed on perceived behavioural responses,

perceptions of the informativeness of DTCA and motivations for responding to DTCA were

not explored and could be examined in future research.

The outcomes from our large representative sample can be generalized to national

population in New Zealand and have important implications for both healthcare policy

makers and pharmaceutical companies. This research suggests that regulations on drug

advertising should be tightened. Moreover, health policymakers should increase knowledge

regarding drug advertising and let individuals know that advertised medications are not

necessarily safe and effective. Health policymakers can also concentrate on people's attitudes

towards advertising of prescription drugs, and let them know that it is a paid promotion

conveyed by pharmaceutical companies. Health professionals need to be well informed of all

medications prior to them being advertised to help individuals make safe choices.

Furthermore, pharmaceutical companies should advertise their medications responsibly and

educate individuals about treatments constructively since people, especially those who are

more vulnerable, may ask for a medication that they do not need. Drug advertisements can

discuss lifestyle alternatives to taking drugs and state that there are other medications

available, which may have the identical effects.

22

CONCLUSIONS

　　While much attention has been paid to perceived behavioural responses to drug advertising, to the best of our knowledge, no study has documented 'at risk' individuals' perceived behavioural responses to drug advertising. This study, therefore, grounded in communication inequality and the structural influence model, presented the factors predicting individuals' self-reported behavioural responses to drug advertising. This research found that 'at risk' individuals were more vulnerable to drug advertising as supported by the representative empirical findings. Furthermore, the outcomes revealed the importance of attitudes towards DTCA over and above knowledge of regulation and safety of advertised drugs, which can leave individuals vulnerable to drug advertising and at risk of making uninformed decisions accordingly. The current research also addressed the important question of whether materialism has effects on self-reported behavioral responses to drug advertising and revealed that respondents higher in materialism were more likely to be affected by drug advertising, suggesting they might pay more attention to advertisements, or DTCA might be appealing to their consumerism, a trait that is associated with lower psychological well-being.[59]

　　Taken together, the outcomes suggest drug advertising affects the most 'at risk' individuals, who base their decisions on their attitudes, who are motivated to consume, and who rely on the Internet for medical information. The findings raise significant concerns regarding ethicality of DTCA and suggest a need for policy developments to ensure medicine advertisements are ethical and do not cause misuse or overuse of medications.

23

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